your attention to the fact that we found *inversions*, as they are now called; that is to say, to take an instance, if we represent three lines of a spectrum by *a*, *b*, and *c*, we have found among the most widened lines in spots *a* without *b* and *c*, *b* without *a* and *c*, and *c* without *a* and *b*. Now that is a condition of things impossible to understand or explain on the old view.

We next continued the discussion over another region of the spectrum, and we found that the result held absolutely good, that is to say, in other regions we got these same inversions. If we look at a map belonging to another period, although the lines change, the inversions remain, and the lines behave very much in the same way as the other. This result is quite constant for all regions of the spectrum examined. Hence, finally, we learn that these inversions hold good for different periods, and for different parts of the spectrum; and we have found that spectroscopically any one vapour in the spots behaved in exactly the same way as various mixtures of many vapours would be bound to do.

The result of this inquiry with regard to chemical substances which have been most carefully worked out, is indicated in the accompanying table, giving the result of the work for two years from 200 spots.

Statistics of the most Widened Lines seen in 200 *Sunspots at Kensington*

	Total number of lines in part of spectrum discussed	Total number of lines widened
Iron	172	72
Titanium	120	38
Nickel...	24	9
Zinc	19	5
Cobalt...	17	3
Calcium	17	7
Chromium	15	9
Molybdenum	14	1
Tungsten	14	2
Manganese	13	4
Platinum	12	1
Barium	10	1
Copper	10	1
Sodium	7	2

In these 200 spots out of 172 lines of iron which we might have seen only 72 were observed altogether; out of 120 lines of titanium which we might have seen only 38 were seen; and then the number goes on decreasing: 24 in the case of nickel, of which 9 were seen; 19 in the case of zinc, of which 5 were seen; 13 of magnesium, of which 4 were seen; 12 of platinum, of which 1 was seen, and so on.

The final upshot is, therefore, that at the spot-level we do not see the Fraunhofer spectrum, as we ought to do on the old theory. What we do see is a small percentage of the lines, and we see them under conditions which are entirely unexpected. No one, I think, who knew anything about spectrum analysis would have anticipated the result which we have got at Kensington in these 700 observations.

These, though the earlier results, are not the only results which we may hope to get by going on with the work. At present we have limited ourselves to recording the dates of the spots. But this is not enough; we must know the actual positions of the spots on the sun. We must note whether each particular spot is in the northern hemisphere or in the southern hemisphere, with the view of determining whether there is any chemical difference between the north part of the sun and the south part; and then again we shall have to compare the latitudes of spots, with the view of determining whether there is any difference in the chemistry of the spots according to the latitude. I may tell you that we are working at that particular point just now, and it really does look as if the sudden changes in the spectra recorded may have been due to the fact that the spots compared were spots varying very considerably in latitude, and it would not surprise me to find that spots which are very like each other in their spectra will be found to be situated more or less in the same degree of latitude,—whether the same degree of latitude north or south we do not know. And there is another question, too. I pointed out that there is a considerable number of lines seen in the spectrum of the arc which are left out of the spectrum of the spark. Now, will that help us at all in our inquiries? I think perhaps it may. Everybody assumes that the electric spark is hotter than the electric arc. If that be so, the lines which we see at the temperature of the arc, and which we do not see at the temperature of the arc only, may represent the lines due to cooler vapours—more complex molecular groupings it may be, which can exist in the cooler temperature, but which entirely break up on the application of a higher one. If that be so we shall be able to sort out the spots more or less according to their temperature.

Though the results have not been shown on the maps, the lines visible in the spectrum of some substances at the temperature of the oxy-hydrogen jet have been observed. Everybody assumes that the temperature of the oxy-hydrogen jet is lower than the temperature of the electric arc or spark; so that, if we can get a spot which gives us those lines thickened only which we see at the temperature of the oxy-hydrogen jet, we should be perfectly justified, I think, in saying that that was a relatively cool spot; whereas, if we saw a spot which only had those lines thickened which are intensified on the passage from the temperature of the arc to the temperature of the spark, we should be justified in saying that that spot was very much hotter. I only throw this out as an indication of the kind of result which probably future working and future thought will bring out, and that we are by no means at the end of the work yet.

J. NORMAN LOCKYER

(*To be continued.*)

UNIVERSITY AND EDUCATIONAL INTELLIGENCE

OXFORD.—The new Medical Statute was finally approved by Convocation on March 16. The scope of the new Statute and its bearing on the study of medicine at Oxford were so clearly described by Prof. Burdon-Sanderson in last week's NATURE, that it is unnecessary to refer further to them. One point insisted on by the Professor, that the present student of medicine wastes his first year over Pass Moderations, has not yet been corrected. The Moderations Committee are still deliberating, but there seems little doubt that students of Natural Science in Oxford will receive substantial relief under the new scheme.

The present year is one of reform. While the Moderations question is still under debate, a new and much-needed reform has been sprung upon the University. The old Examination in the Rudiments of Faith and Religion has by common assent become out of date. Last week the preamble of a new Statute was passed *nemine contradicente* in Congregation. We must wait till next term to learn the fate of the Statute itself. It seems time that the University should grant degrees without demanding an intimate knowledge of the Thirty-nine Articles.

CAMBRIDGE.—It has been decided to establish a Tripos Examination in Engineering, to be combined with the present Natural Sciences Tripos. The general basis is that, as an alternative to the present First Part of the Tripos, an examination in certain mathematical subjects useful in engineering, physics, chemistry, and theory of structures shall be held, to be followed by a practical examination. Those who pass this will be entitled to a degree in honours. A later examination, concurrent with the second part of the Natural Sciences Tripos, is to consist of advanced papers in Physics, Chemistry, and Engineering, distinction in one or more of which is to entitle a student to a first class. When the complete scheme is published we shall give full details.

SCIENTIFIC SERIALS

The Journal of Physiology for November 1885, vol. vi. No. 6, contains:—On a double differential rheotome, by Dr. W. D. Samways (plate 7). The instrument is described and figured.—On the blood of Decapod Crustacea, by Dr. W. D. Haliburton (plate 8). Assisted in part by a grant from the British Medical Association, the author has studied the blood in the lobster, the edible crab, the crayfish, Astacus, and *Nephrops norvegicus*; and he treats of its colour, constituents, and coagulation. He ascribes the clot as due to the formation of a body scarcely to be distinguished from the fibrin of vertebrate blood, and believes that its formation is due to a ferment action, which latter is derived from the amœboid corpuscles of the blood. At the close of the memoir the author treats of the comparative aspects of crustacean

blood, and gives a table of the invertebrates in which hæmocyanin and hæmoglobin have been found.—On the nature of papain and its action on vegetable proteid, by Dr. Sidney H. C. Martin. The proteids present in papain are globulin and albumin, and two forms of albumose. No peptones were found.—Regarding the influence of the organic constituents of the blood on the contractility of the ventricle, by Dr. Sydney Ringer (plate 9). He infers that the arrest of contractility with a saline solution is not due to the removal of pabulum to support the contractions, but that lime and potassium salts are necessary ingredients in a circulating fluid to supply the conditions essential to the change occurring during a contraction, there being stored up in the muscular tissue a material to carry on contractions which cannot be washed out by a fluid circulating in the heart cavities.—On the nature of glomerular activity in the kidney, by J. G. Adami. It would seem that the glomerular epithelium has properties of a definite secretory nature; they may even be regarded as (in the dog) having powers of a selective secretory nature.—Plethysmographic and vaso-motor experiments with frogs, by Dr. Fred. W. Ellis (plates 10 and 11).—On some vaso-motor functions of the spinal nerves in the frog, by W. Horscraft Waters.

The Journal of Anatomy and Physiology for January 1886, vol. xx. part 2, contains:—Prof. Macalister, morphology of the arterial system in man, part i.—R. Austin Freeman, the anatomy of the shoulder and upper arm of the mole (plate 5).—Dr. Hans Gadow, on the reproduction of the carapax in tortoises (plate 6). In the case experimented on, the dermal armour was cast off, after injury, down to the soft cutaneous layers; the bulk of these produced cutis, which then underwent the normal process of ossification, until at last a new complete armour was formed. The author cites, as an analogous case, "the reproduction of bark from the *whole surface of the cambium* laid open after the destruction of the old cortex." Is this so?—Dr. A. M'Aldowie, on the development and decay of the pigment-layer in birds' eggs.—Dr. D. J. Cunningham, the connection of the os odontoideum with the body of the axis.—Dr. R. W. Shufeldt, on the skeleton of Geococcyx (plates 7-9); a very full account of the skeleton of this rare bird.—Dr. Noël-Paton, relationship of urea-formation to bile-secretion; part ii. of these important experimental researches. The formation of urea in the liver bears a very direct relationship to the secretion of bile by that organ.—Dr. W. Hunter, recent histological methods.—Prof. W. Turner, the sacral index in various races of mankind; makes two classes—where the sacral index is below 100 (Dolichohieric), and where it is above 100 (Platyhieric).—Dr. J. L. Gibson, the blood-forming organs and blood-formation, part ii.

Zeitschrift für wissenschaftliche Zoologie, Band xliii. Heft 1 (Leipzig, December 31, 1885), contains:—Prof. A. Kölliker, histological studies of Batrachian larvæ (plates 1 and 2). Almost forty years ago Prof. Kölliker published his first account of the development of the Batrachian tissues, but the improvement in methods of research and the expansion of knowledge as to nerve-bundles and other endings have caused him to alter his opinions on several matters, and in this memoir we find his latest views on the structure, development, and terminations of the nerves; also some general considerations of the structure of the nerve-fibre and on the development of the blood- and lymph-vessels.—W. Schwarze, on the post-embryonal development in Trematodes (plate 3). These researches were made on *Cercaria armata* and *C. echinata* from *Limneus stagnalis*, and on *C. ornata* and *C. spinifera* from *Planorbis corneus*. A useful bibliography of the literature is appended.—Hermann Uhde, on the dorsal pore of the terrestrial Oligochæts: a contribution to the histology and classification of the Lumbricidæ (plate 4). In this memoir, in addition to a very detailed list of the literature of the subject and to a chapter on anatomical details, we have an account of the various species, based on materials collected from various parts of the world.—Dr. Deichler, on Protozoa parasitic in the sputa of whooping-cough.—Dr. E. Witlaczil, on the morphology and anatomy of the Coccidæ (plate 5).

Morphologisches Jahrbuch (Gegenbaur's), Band xi. Heft 3 (Leipzig, 1885), contains:—Dr. Béla Haller, researches on the marine Rhipidoglossa (plates 17–24), part ii. The first part of Haller's researches appeared in vol. ix. The present part treats of the structure of the central nervous systems and their envelopes. The material operated on was obtained at Trieste from Fissurella, Haliotis, and Turbo, and the conclusion is arrived at that without doubt the nerves throughout this group of Mollusca have a double origin.—Dr. H. Virchow, on the form of the plicæ of the ciliary body in mammals (plate 25). These folds, so comparatively small in the human eye, are largely developed in the rabbit.—Dr. W. Pfitzner, on the division of the nucleus in Protozoa (plate 26). These observations were chiefly on the nuclei in *Opalina ranarum*, and show the general similarity of the kariokinesis in this Protozoon with that in Metazoa.—Dr. G Baur, notes on the "astragalus" and the "intermedium tarsi" in mammals (plate 27). As introductory to these notes a very copious account of the literature of the subject is given.—Among the short notices are: on the nerve-canal in the humerus of the Amniota, by Prof. U. Fürbinger; and on the rudiment of a septal nasal gland in man, by Prof. Gegenbaur.

Rendiconti del Reale Istituto Lombardo, January 21.—On the grape-vine mildew; observations and remedies, by Prof. Gaetano Cantoni. Although usually supposed to have been for the first time introduced into Europe from America about 1877, the writer quotes a correspondent in the *Bulletin* of the French Agricultural Society, who states that this disease was known in Alsace under the name of *mildau* over forty years ago. From Alsace it passed to America, where the name became Anglicised, recently returning to Europe under the designation of grape-vine mildew. The best prophylactic remedies hitherto discovered are the sulphate of copper and milk of lime, applied either separately or in combination about the beginning of June, and repeated, if necessary, towards the end of August or beginning of September.—On the formation of dew, by Prof. Giovanni Cantoni. It is shown that the theory recently communicated by Prof. Aitken to the Edinburgh Royal Society and described in NATURE for Jan. 14 (p. 256), agrees with the conclusions already arrived at by Fusinieri, Melloni, and other Italian meteorologists.—Summary of the meteorological observations made at the Brera Observatory, Milan, during the year 1885, prepared by E. Pini.

Mittheilungen der Naturforschenden Gesellschaft in Bern, Nos. 1092–1132 (1884–85).—Wind and precipitates in Bern (from records of Bern Observatory during fifteen years), by Herr Benteli.—On a case of rapid hole-formation in rock, by Herr Baltzer.—On lake-balls, by Herr Coaz.—On the theory of trisection of angles, by Herr Moser.—On the termination of nerves in striped muscles of man, by Herr Flesck.—On a case of loess in Canton Bern, by Herr Baltzer.—On the oldest map of Switzerland of Ægidius Tschudi, by Herr Graf.—Mathematical researches on the colour of thin gypsum plates in polarised light, by M. Jonquière.—On the poisoning with *Amanita phalloides* in Bern in 1884, by Herr Studer, jun.—On the occurrence of the vascular wave in the carotid-curve, by Herr Mützenberg.—Contributions to a comparison of the brain-fissures in Carnivora and Primates, after examination of a lion's brain, by Herr Familiant.—On the chemistry of food-stuffs, by Herr Fueter-Schnell.—On a new occurrence of rock-crystal in Switzerland, by Herr von Fellenberg.

Verhandlungen der Schweizerischen Naturforschenden Gesellschaft in Lucerne, September 1884.—We note here the President's (Herr Suidter-Langenstein) opening address, dealing with the Lucerne region in geological, meteorological, and biological aspects; also two interesting reports on prize competitions—one relating to a climatology of Switzerland, the other to the deep-water fauna of Swiss lakes.

Journal de Physique, February.—On refrigerating mixtures and the principle of maximum work, by M. Potier.—On the critical temperatures and the pressures of some gases, by MM. Vincent and Chappuis.—Researches on the freezing temperature of solutions, by M. Raoult.—On the formula of plane gratings, by M. Branly.

SOCIETIES AND ACADEMIES

LONDON

Royal Society, December 10, 1885.—"On the Magnetisation of Steel, Cast Iron, and Soft Iron." By John W. Gemmell.

In this paper the author describes and gives the results of a series of experiments upon particular specimens of iron and of steel. The specimens consisted of wires of "soft Scotch iron," "common wire," "charcoal iron," and "soft steel," with bars of cast iron and malleable iron; and the object of the investiga-